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THE GEOLOGICAL LAWS OF THE POPULATION

WITH SPECIAL REGARD TO THE CZECHOSLOVAK REPUBLIC.

BY

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The density of the population depends, as is known, very much upon the mineral wealth of the region, from its fertility or sterility, further upon its accessibility, the height and consequently upon the temperature, upon the moisture and other factors. It is therefore in the first place the combination of the ground and the morphological character of the region one of the natural circumstances which cause greater or less density of the population, and which directly or indirectly are dependant on the geological developement of the region.

I put forward in this work in what details, till now unknown, the results of the geological circumstances on the density of the population are. I studied more especialy the condition in the regions of the Czechoslovak Republik making use, besides the distinct geological maps, of the statements of the State Statistical Office, namely the clear charts of the density of the population according to the last conscription of 1921. Besides this, I made use of the charts of classification of the population in farmers, industrials and s. o.

In this I owe to Mr. Dr. **Philip Počta**, the director of the Geological Institute of Charles-University, my teacher, my warmest thanks for the numerous valuable hints and his kindness to me in all my work.

* * *

The Plan of this study is approximately given in these proposition:

Firstly I recognised that the size of the provinces, all of which have the same density of population, are directly in harmony with the geological formations.

According to this, the Czechoslovak Republic can be divided into parts which have the some density of population, whose size and density is proved scientifically, specially geologically, as I show in my work — for example the South-bohemian province which extends into South-western Moravia and which precisely corresponds with the size of the crystalline district; then the province of North-Bohemia, which extends over the whole of Moravia, given and corresponding with the chalk-regions + the non-carboniferous cenozoic a s. o. — The legality, which I have demonstrated of the condition of the statistics for the population with the geology of the Czechoslovak Republic, serves also with certain deviations for every province.

It often happens that the mountain formations of different geological qualities, are fit or unfit for settlement.

It is necessary to notice that the geological effect is sometimes through different influences hidden, for instance through industry, the localization of which is generally also the consequence of geological conditions, but only secondary differences and combinations.

It is the aim of this treaty to draw the attention and demonstrate these correspondences and some digressions, as far as they belongs to geology.

The western and eastern halves of the Czechoslovak Republic are in their developement and their morphological character quite different from one another. At first sight this difference is evident on the chart of the density of the population also. It is necessary to seek the relations of both in sefout cases. In Bohemia and Moravia there is a complex of places with a small density of population so dislocated, that it almost precisely covers the granite districts and the district of crystalline slates, then of course chiefly the district of gneiss.

If we at the same time follow the geological map and the chart of the density of the population, we see that they both stretch in the same way from the Teplá-heights, extend themselves in South-Bohemia, and indeed encroach upon Southwestern Moravia.

The provinces in Eastern Slovakia have the same density of population as these places, but although the reason is a geological one, the conditions are quite different, as I will here after notice.

The size of Bohemian and Moravian provinces with such a small density on the gneiss subsurface can be understood. This refers to the accesible places without mountains, where the small hills would not be against settlement, but the ground is mostly only suitable for agriculture. There are generally no conditions for industries, and agricultur requires a broader stretch of land for the nourishment of man.

I could not assert the difference, which is caused by the differance betwen the subsurface and the crystalline slate, at least I could not assert it in general. These differences are, of course, so trifling, that they are almost quite effaced by other conditions. One can understand it, when we consider that also the composition of both is identical or do not differ more, than the separate types of gneiss differ from each other.

In the Šumava in the Hartmanice district the density of the population is the least of the whole western half of the Czechoslovak Republic; it scarcely reaches 40 inhabitants for 1 km^2. The reason is of course in the natural conditions and namely chiefly in the height and inaccessibility of the mountains and then in the geological composition; micaslate, of which the whole district is composed is from a agricultural and industrial point of view, quite worthless.

In Northern Bohemia, on the other hand, the frontier districts, also like wise composed of crystalline rock-formations or of granite, show large settlement. But this refers altogether to an industrial province, where the quite unfavourable geological conditions permit of almost no agriculture necessitate the developement of industry, which is not dependant on these qualities of the land; and in the industrial district the numerical density of the population is a usual phenomenon. Besides the attractive power of the brown coal field has a influence here.

This deviation, which disturbs the harmony between the places of density and the geological map, is still more evident in the important islands, which the large towns form. The natural and fundamental geological conditions, which made their foundation possible, quite dissappear in the preponderance of the known attractive power of the large industrial towns. At Plzeň the conditions are combined through the neighbouring coal mines. I will revert to this again in my treaty.

On the whole one can assert, that the places with a small density of population are in Bohemia and Moravia almost all bound to the regions of crystalline slates and granite, so far as this does not refer to a row of North-Bohemia industrial districts. But also in North Bohemia this dependence is evident and namely in the district Rokytnice, Maršov and Roketnice, further in the mountains Orlické hory, where the influences of geological conditions are not sufficiently annulled by industry.

As regards the other geological formations, it seems at first sight, that their influence on the density of the population is less evident. But this is only seemingly and the reason is that these are not such large districts, so that a small difference between the chart of settlement and the geological map is not so strikingly prominent. Further study will demonstrate the truth of this.

In Central Bohemia a broad line of districts stretches from Prague in a southwestern direction, which are strikingly not agricultural, and are characteristic for the density of their population; this line is very evident on the chart of the relative quantity of their husbandry. This line coincides in the ground plan very evidently with the district of the central Bohemian paleozoic formations (the Barrande „Silur-bassin“).

In any case it is necessary to consider, if we proceed from small details, that a statistical chart gives a clear view of the density in separate districts, which in any case then constitute political formation, which are artificially limited. Notwithstanding the details, where there is a geological difference, where single formations differ, there one can also see the difference in the density of the population and vice versa.

On the chart of the relative quantity of agricultural population are important in Central Bohemia two non-agricultural centres, namely the environs of Prague and Plzeň which some-where in the district of Zbiroh are bound together by a quite narrow line. Analogically we find the same also on the map of the density of the population, and exactly the same on the geological map.

On the chart of the density of the population one sees a line greater of density with two centres: Prague and Plzeň, which are broken sharply with the district of Zbiroh. The neighbouring districts all have over eigthy inhabitants, but the district of Zbiroh has a much lesser number, forty one to sixty inhabitants per square kilometre.

The attractive power of both large towns in these remote districts is trifling, but the enlightenment the geological conditions will give us, if we wish to see from the large town centres. We will find on the geological map the same two centres, which do not encroach on one another. In the environs of Plzeň there is a coalfield; in the districts southwest of Prague it is the ground, composed of the fruitfull limestone, important for the industry (silurian, devonian), and there is much iron ores.

Between these two groups lies a place quite without any mineral significance, so that through this there is a striking spring in the relative number of the inhabitants.

Round about these complexes of rich paleozoic places and among them there is a circle of quite unfruitfull eozoic rockspecies. The density of the population on this subsurface is very small, often smaller than in the district of crystalline slates. One can see it clearly in the districts of Křivoklát, Kralovice, Jílová, Dobříš, Neveklov. The eozoicum has also from a statistical point of view the same, often also less value as the gneiss-districts.

It is superfluous for us to mention the districts, which the presence of coal characterizes and to notice, it is the places which were almost solely rightly applied, so far as the geological action concerns the density of the population.

The striking density of settlement in the district of Kladno and partly also the district of Slaný is caused by the industry which is supported by the coal mines. In the district of Teplice, Duchcov, Most and the neighbouring districts there is the same apparance, but with respect to the size and to the developement of the undertakings, which are founded in the cenozoic basins of brown coal.

Up to now we have not spoken of the explanation of the conditions of settlement to the geology of the whole Northeast quadrant of Bohemia. All districts, which lie there, except the already mentioned frontier-districts, differ in the relative-number of inhabitants and also geologically, and except the districts of Dubá, Bělá and Mimoň on the one side, Hradec Králové on the other side, have a density of 81—200 inhabitants per 1 km^2.

On the map of settlement they make the impression of a uniform complex; if we compare it with the geological map, it is evident at once that this complex coincides complectly with the extension of the cretaceous-formation. That this so extended complex has the same uniform settlement, is caused by the same way as with the crystalline complex of South Bohemia. The geological conditions are uniform, there are no districts which differ in a striking way through the wealth or through the composition of the soil or through the mountanous condition or the sea level generally.

We can observe the details.

In the North these two chart complexes — geological and population — follow the stream of the Elbe. In the district of Ústí and Litoměřice they deviate a little to the East, compensated by the dense settlement caused by the encroachement of the rich cenozoic systems and by the industrial centres. Already a little to the South the districts with a normal density for North-east Bohemia return far to the west, at the same time following the cretaceous-formation, exactly their neighbourhood with the coalmine districts of Slaný and Kladno. Then advances this complex of density and at the same time of the cretaceous-formation over the district of Karlín and Brandýs, always a little to the south of the Labe, and finally once more corresponding turns to Polička and encroaches on Moravia.

The northern limit is not distinct, because the density of the population corresponds with the density of the unfruitful but industrial districts of Sudety, of which we have already spoken.

One must mention the districts which form exceptions. As far as it concerns the district of Hradec Králové, it has a great density, because the natural conditions — according to my view — can have no explanation there, perhaps it concerns there the artificial conditions. This exception is more over the only one and not very important.

On the other hand the small group of the three neighbourry districts, Dubá, Mimoň, Bělá, have relatively few inhabitants, namely 40—80 per 1 km^2. That in this case it concerns a geological cause, is confirmed also by the statistics of agriculture, which precisely in this place shows the greatest density of agriculturists in all Northeast Bohemia.

On a smaller scale it is the same case in the district of Litomyšl and the neighbourey districts, which show a smaller density of the population as against the neighbourey districts to the North and at the same time also the largest settlement of agriculturists. And finally the best and incontestible proof and explanation of these differences we find if we observe a detailed geological map, where the cretaceous formation is further divided:

Just both these districts, as Litomyšl as Dubá and environs lie upon sand strata, which were (formerly) called the strata of Jizera, but the other districts are built up of the strata of Březno and Teplice which have a strikingly different petrographie character.

The influence of these compositions cannot be contested, and in the districts where they are not annulled by the higher disturbing influences, as for instance in the district described, it goes to the almost surprising details.

As regards the river districts, plistocen and holocen, I am convinced that by more detailed study, one could find traces of its influence. It is certain that for instance on the Elbe and other places where the deposits are greater, the influence is evident; but the fact that the expansion of political districts often encroaches on severel geological formations, hinders the observation. The geological composition is known to the smallest details, but the density of the population is only given for greater complexes. In some districts, for instance Pardubice and others, we see the dependance of the settlement on geology also by the larger number of agriculturists.

Therefore, if we look from the small details, I have explained the influence of geology in Bohemia. In Moravia I have already mentioned the southwest point, which is geologically and according to the small density of its population, only a continuation of Bohemia. It is the same case in Northern Moravia and Silesia, where chiefly in the districts, Staré Město, Visenberg and in a row of neighbouring districts, there is a very small density. In the first two districts it moves between 41—60, in the others between 61—80 inhabitants per 1 km^2 — it is therefore the same as in Sonthwestern Moravia and in the southern half of Bohemia.

All these districts are in any case very far from each others, but they approach one another through similar settlement. The case also is the same all are formed of crystalline rockspecies.

As far as the others influences act, they are of such a character, that their results mutually disturb themselves. In the western part, in a row of districts south of Cukmantl, characteristic through the density sixty to eighty inhabitants, the subsurface is chiefly kulm. Kulm is geologically quite different, not comparable, but as regards the influence on the population, it has very similar qualities.

Then the rockspecies, which as regards the geological age and the row of petrografic and other qualities are different, can have almost the same action on the settlement.

Also in other places in Moravia it is very evident: From Northeast to Southwest in a broad line, which goes over the whole of Moravía, there are judicial districts which — with trifling exceptions — on the whole have the same density of population (81—200 inhabitants per 1 km^2).

On the map of the population this line shows itself as though it were a continuation of the similar settled complex of North, Northeast and East Bohemia, and we obtain the same impression if we compare the geological condition. The extension of these districts agrees with the complex of the cretaceous-formation and the cenozoic; in any case both are geologically quite different, but almost quite similar as to population.

If we were to show with the same colour on the geological map of Bohemia, Moravia and Silesia, with other words, the cretaceous and cenozoic, we would get a picture, which would precisely coincide with the expansion of the line of districts mentioned, which are shown on the chart of the settlement.

In the Northwestern part of Moravia the density of population depends on the extension of the Bohemian chalk formation. The districts of Blansko, Plumlov and Konice have a varied geological subsurface, but this does not affect the whole. And finally the whole of South Moravia, Southeast Moravia and East Moravia form, as regards the settlement, almost a uniform complex, the cause of which lies in an also uniform geological construction. They are the cenozoic and cretaceous silts; as I have said, these rockspecies are in this respect quite similar.

In the south part of Těšín and both limits of North Moravia the districts are again formed of chalk formation and have according to my rule quite such a density of population.

It is unnecessary to speak about the geological cause of the great number of inhabitants in the districts of Ostrava; the limits of the coal zone agree very precisely with the extension of those districts, as one can convince one's self on comparison of the maps. In Opavsko the conditions are more complicated. Also there, there are certain relations between the density of population and the expansion of geological formation, but on the frontier the precise comparison dissappears.

In Jeseník there is a smaller number of inhabitants, than we could expect; in the North, on the other hand, on the same geological subsurface, the density increases. It is evident, that it is just the height of Jeseník, which causes these differences. If we take the mountains into consideration, we find several complexes of the same density which conform with the expansion of geological elements. So the difference between the districts is evident, which group on the one side with the Opava district (the subsurface is of Kulm) and the district of Javorník on the other side.

Notwithstanding the dependence is not so convinciny, although it is incontestible, as there, where it is not disturbed by other factors. A similar phenomenon we find not only in Silesia, but also in Slovakia. The cause is clear: There where the geological formation is of the same quality in a larger and connected expansion, it has a regular consequence of expansion a similar formation of places of the same population. This is a law not known up to now.

On the contrary in the very varied places geologically the influence only then appears distinctly, when the rockspecies which form these districts, are similar to suitability or unsuitability; geologically can be quite different.

All this is seen in Slovakia.

In their western half the judicial („slúžnovské“) districts of Malacko and Senica are the most streking, which appear as islands with a trifling density of population. In the geological map there is on the same place a strip of land, similar in form and sharp limits, geologically different from the environs, and on the geographical map we see there the Small Carpatians extending from the plain.

Here it is this very evident haw a geological cause has its consequence in the deviating geographical conditions, then also in all conditions (for instance in the botanical) and finally also in the density of the population.

The characteristic number of inhabitants in the whole West-Slovakia is sixty to eighty inhabitants per square kilometre. If we bear in mind the details and the two already explained districts, we find those districts form an exception which lie on one connected shore of the Váh.

This concerns the districts which commence with Nové Město on the Váh, and which extands from here far to the South. In these places the density is a little larger, it is about a hundred inhabitants; it is even to be understood that the cause of this phenomenon are the qualities of river district of Váh („Pováží“), which are given through the geological conditions. The plain of young sediments of the river is suitable for settlement in many directions better than in the environs; the good railway connection and communication general make this possible.

From these general perceptions we come to the deviations, which appear in detail on the west part of Slovakia.

Especially striking deviation are the towns which in any case form islands with a higher number of inhabitants. We will not occupy ourselves with this, as the causes have mastly a commercial and industrial character. It is best to be seen in the Bratislava district, where in any case also the attractive power of a large town is very strong.

In the district of Prievidza the settlement grows in a very striking way: While the neighbouring districts have about 50 inhabitants per 1 km^2, this number in Prievidza is twice as large. The cause of this density is the proximity of the coalmining industry between Handlová and Prievidza.

A good proof of this can be seen in the district of Bánovce, where the same geological formation is developed and also all the same conditions prevail, sufficiently unprofitable, but there are no mines there and therefore Bánovce is a place much less settled.

From this explanation of a detail it is necessary to return to the number 61—80, which represents to us the density of all other districts in West Slovakia. The southern part of this complex is principally constructed of the plistocenic sediments of the Danube and its tributarecs, so that geologically — and according to my laws also from a population point of view — is uniform. On the other hand the northern part is all moutanous, for it has on the whole the same qualities; it has no particular wealth and so this number, fifty inhabitants per one square kilometre, deviates triflingly, and can be well understand. It coincides with the density of the southern provinces, the ground is formed in another way.

There only remains the problem of Eastern Slovakia and the Podkarpatská Rus.

They both show a complete similarity. Their density is given by the average number always under 60 (in some places even under 40) inhabitants per 1 km^2. It is necessary to explain this number, then the deviations explain what concerns this number, and where it concerns a greater number in some districts; then we must also observe the dislocation of the districts, where there are less than 41 inhabitants per 1 km^2 — in any case so far as it concerns the geological standpoint.

The general number is generally given by the natural conditions which are dependant on the geological developement of the mountains and which in any case are not sufficient for the nourishment of a greater number of people.

It is the same as in the North, when the soil is composed of uniform flisch-curves of the Carpatians, as also in the South, so far as the mountains extend. Further South, chiefly on the borders of Slovakia and Podkarpatská Rus, the density of the population strillingly grows: In these districts a quite deviating formation encroaches on our Republic from the South, namely the Hungarian plain, formed of young deposits.

It has shown itself regularly, that those districts whose soil is of such river deposits, are not densely settled, because they possess no mineral wealth and there agriculture flourishes. On the other hand in Slovakia and Podkarpatská Rus those provinces are still more suitable for settlement than the mountanous northern districts.

This thing is strikingly evident, where these plain plistocenic formations are mostly developed, namely in the southern half of East Slovakia and in the Western Podkarpatská Rus. There the population, namely in the districts of Sečovce, Michaľovce, Dolní Michalany, Kapušany, Kr. Chlumec, Nosinovo, Rosvigovo, Iršava, V. Serljuš, Hust, can be expressed with the number of abaut 70. In some districts, for instance Iršava, this number is a little higher through the mines and iron ore.

In the Mukačevo district the density is about a hundred inhabitants per one square kilometre, but this size, as I think, is not caused by geological causes.

In the northern part of Podkarpatská Rus in all its lenght, there is a uniform density of population, always less then 40 inhabitants per 1 km^2 — in Rahovo district is scarcely 18 inhabitants; this is the least density in the whole Czechoslowak Republic. The extensin of these places agrees completely with the strips of land of the Carpathian flisch, which shows better in this way its unsuitability for settlement. The Tiačov district at best approaches through its relative number of inhabitants to the other southern districts, of which it is a neighbouring district and to which it is somewhat similar geologically; and the Bočkov district with a density of 41—60 inhabitants per 1 km^2 differs from the environs geologically and namely by its salt and iron ore mines.

The districts Lučenec, Feled and Tornala in East Slovakia form a similar group. Here the presence of coal mines acts on the conditions of settlement.

Finally there remain only two insolved complexes of districts with a density of under forty inhabitants per one square kilometer, and namely 1. Zvoleň, Krupina and Malý Kameň, and 2. Spišská Nová Ves, Kežmarok, Spišská Sobota, Hrádek, Ružomberok, Brezno, Pohorelá, Revúca, Rožňava and Ratková.

The explanation of this small density I have not been able to derive from geological conditions with precision, although it concerns the action of nature. The ore deposits have not here simply such a significance to annull the action of the mountains in the South and the Carpatian flisch in the North.

* * *

Therefore I have given the superficial picture of the relations between the density and other attributes of population and the geological conditions in the Czechoslowak Republic. So far as they apply to other districts, it will be necessary to add also others sorts of deviations, which were not here, as for instance the action of ice fields in the North and so on. Such deviations are often a secondary consequence of geological conditions. —

It was known, that the natural conditions are also important factors for the number of inhabitants, but besides the influences of coal zones and others, the influences of geology up to now remained almost without realization.

I am convinced that — sometimes! — also the habits, types and language of the population are to a certain extent dependent on the geological attributes.

It was the aim of this study to publish, to found and logically to deduce my low of the influence of geology on the population, which approximatelly is compresed in following brief formula.

The geological formation of the same worth has regularly as a direct and indirect consequence — with the mentioned types of deviations — a similar formation of the same population, from the expansion and other attributes point of view.

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